WHAT IS CLAIMED IS:

1. A method of forming a silicon oxide layer over a substrate disposed in a substrate processing chamber, the method comprising:

flowing a process gas a silicon-containing gas, an oxygen-containing gas and a fluorine-containing gas that is different from the silicon-containing gas into the substrate processing chamber;

depositing the silicon oxide layer over the substrate by forming a high density plasma from the process gas and biasing the plasma towards the substrate to generate a sputter etching component simultaneous with film deposition, wherein the substrate is heated to a temperature of at least 500°C during deposition of the silicon oxide layer and wherein the deposited silicon oxide layer has a fluorine content of 1.0 at. % or less as measured by using Secondary Ion Mass Spectrometry (SIMS) techniques.

2. The method of claim 1 wherein the sputtering element of the deposition process slows deposition on corners of raised surfaces the silicon oxide layer is deposited over thereby contributing to an increased gapfill capability of the silicon oxide layer.

3. The method of claim 1 wherein the substrate is heated to a temperature of between 650-750°C during deposition of the silicon oxide layer and the silicon oxide layer is used to at least partially fill a trench etched as part of a shallow trench isolation structure.

4. The method of claim 1 wherein said silicon oxide layer has a fluorine content of 0.6 at. % or less.

5. The method of claim 4 wherein the silicon-containing gas comprises SiH_4.

6. The method of claim 5 wherein the fluorine-containing gas comprises NF_3.

7. The method of claim 6 wherein the oxygen-containing source comprises O_2.

8. The method of claim 6 wherein the silicon oxide layer is an undoped silicate glass layer (USG).

9. The method of claim 6 wherein the silicon oxide layer is doped with phosphorus and the process gas further comprises a phosphorus-containing gas.

10. The method of claim 9 wherein said phosphorus-containing gas comprises PH_3.

11. The method of claim 1 wherein the process gas further comprises an inert gas.

12. The method of claim 11 wherein the inert gas comprises argon.

13. The method of claim 1 further comprising forming a thin layer of silicon oxide material from a process gas that does not include the fluorine-containing gas prior to introducing the fluorine-containing gas into the process gas.

14. The method of claim 1 wherein the silicon-containing gas is introduced into the chamber from gas nozzles surrounding the substrate and from above the substrate.

15. The method of claim 14 wherein the oxygen-containing gas is introduced only from nozzles surrounding the substrate.

16. The method of claim 15 wherein the fluorine-containing gas is introduced only from nozzles surrounding the substrate.

17. A method of forming a silicon oxide layer over a substrate disposed in a substrate processing chamber, the method comprising:

flowing a process gas a silicon-containing gas, an oxygen-containing gas and a fluorine-containing gas that is different from the silicon-containing gas into the substrate processing chamber;

depositing the silicon oxide layer over the substrate by forming a high density plasma from the process gas and biasing the plasma towards the substrate to generate a sputter etching component simultaneous with film deposition, wherein the substrate is heated to a temperature of at least 650°C during deposition of the silicon

oxide layer and wherein the deposited silicon oxide layer has a fluorine content of 0.6 at. % or less as measured by using Secondary Ion Mass Spectrometry (SIMS) techniques.

18. The method of claim 17 wherein the sputtering element of the deposition process slows deposition on corners of raised surfaces the silicon oxide layer is deposited over thereby contributing to an increased gapfill capability of the silicon oxide layer.

19. The method of claim 18 wherein the silicon oxide layer is used to at least partially fill a trench etched as part of a shallow trench isolation structure.

20. The method of claim 17 wherein the silicon-containing gas comprises SiH_4.

21. The method of claim 20 wherein the fluorine-containing gas comprises NF_3.

22. The method of claim 21 wherein the oxygen-containing source comprises O_2.

23. The method of claim 17 wherein the silicon oxide layer is an undoped silicate glass layer (USG).

24. The method of claim 17 wherein the silicon oxide layer is doped with phosphorus and the process gas further comprises a phosphorus-containing gas.

25. The method of claim 24 wherein said phosphorus-containing gas comprises PH_3.

26. The method of claim 21 wherein the process gas further comprises an inert gas.

27. The method of claim 26 wherein the inert gas comprises argon.

28. The method of claim 17 further comprising forming a thin layer of silicon oxide material from a process gas that does not include the

fluorine-containing gas prior to introducing the fluorine-containing gas into the process gas.

29. The method of claim 17 wherein the silicon-containing gas is introduced into the chamber from gas nozzles surrounding the substrate and from above the substrate.

30. The method of claim 17 wherein the oxygen-containing gas is introduced only from nozzles surrounding the substrate.

31. The method of claim 17 wherein the fluorine-containing gas is introduced only from nozzles surrounding the substrate.